

NIF NEWS

THE NATIONAL IGNITION FACILITY NEWSLETTER

Project Milestones and Achievements

The Department of Energy's positive Key Decision One announcement for the National Ignition Facility (NIF) Project—the 192-beam inertial confinement fusion laser facility—confirmed the project's mission need and set in motion several key project activities.

Industrial Stakeholders' Briefing

In February 1995, Lawrence Livermore National Laboratory (LLNL) hosted the first NIF Industrial Stakeholders' Briefing in Pleasanton, California. The two-day briefing, which drew more than 350 representatives from 240 companies spanning 35 states, encouraged industrial participation in designing and constructing the NIF.

NIF system managers led prebriefing tours of LLNL's Nova and Beamlet lasers. Nova is the predecessor to the NIF and Beamlet is a functional prototype of one NIF beam line. The tours provided an opportunity for industrial participants to see the types of components required for the NIF.

The briefing began with several key speakers expressing their support and enthusiasm for the project. Livermore Mayor Cathie Brown discussed the tremendous community support for the NIF. Dr. E. Michael Campbell—LLNL's Laser Programs Associate Director—discussed the project's key national contributions and the exciting new science regimes the NIF will make available. Dr. Jeffrey A. Paisner—NIF Project Manager—presented a NIF overview and described the critical reviews that will study all phases of the project.

Technical overview sessions provided an opportunity for industrial manufacturers and vendors to discuss the project's technical requirements with NIF Project leaders. Eight sessions addressed system requirements in the following areas: Mechanical, Optics, Beam Control and Laser

Diagnostics, Power Conditioning, Laser Front-End System, Target Area, Facility Construction, and Integrated Computer Control System.

The briefing concluded with an evening dinner featuring keynote speaker Dr. David Crandall, newly appointed Director, Office of the National Ignition Facility (*see article, page 2*). Dr. Crandall discussed the Department of Energy's commitment to the success of the science-based stockpile stewardship program and the NIF Project.



E. Michael Campbell addresses industry representatives at the first NIF Industrial Stakeholders' Briefing.

Science-based Stockpile Stewardship



The NIF is a key component of the Department of Energy's science-based Stockpile Stewardship and Management Program for maintaining the safety and reliability of our nation's remaining nuclear weapons. The NIF, along with other experimental facilities, will provide the data to benchmark numerical simulations that will preserve the knowledge required to maintain our nuclear weapons without underground nuclear testing.



Dr. David Crandall

The NIF and Nonproliferation

The holidays heralded good news for the NIF Project when Energy Secretary Hazel O'Leary announced a positive finding on Key Decision One Prime, the process to determine the NIF's potential effect on U.S. goals of nuclear weapon nonproliferation. The December 20, 1995, announcement allows the release of \$37.4 million budgeted in fiscal year 1996 for detailed engineering design.

The Key Decision One Prime process was originally requested by Congressman Ron Dellums (D-CA) to determine the project's potential effect on U.S. goals of nonproliferation of nuclear weapons. Energy Secretary O'Leary agreed to the process and assigned the Office of Arms Control and Nonproliferation, a Department of Energy entity with no programmatic responsibility to the NIF, to conduct an in-depth study of the NIF's potential proliferation implications.

The study included several public meetings that encouraged public comment and opinions about the project's proliferation aspects. To assure completeness and report accessibility, classified and unclassified draft reports were prepared. These drafts were reviewed by several independent technical and policy experts. Other government agencies, including the Department of Defense, the State Department, the Arms Control and Disarmament Agency, and the Central Intelligence Agency subsequently

reviewed the report and supported its conclusions. Public meetings in Livermore and Washington, D.C., in early 1995 helped determine the study's scope, while additional public meetings in September 1995 collected

"The NIF can contribute positively to U.S. arms control and nonproliferation policy goals."

input on the draft report.

The final report, entitled *The National Ignition Facility (NIF) and the Issue of Nonproliferation*, includes these conclusions: "The technical proliferation concerns at the National Ignition Facility (NIF) are manageable and can therefore be made acceptable" and "The NIF can contribute positively to U.S. arms control and nonproliferation policy goals."

"Therefore, it is the conclusion of this study that the NIF supports the nuclear nonproliferation objectives of the United States."

In her letter announcing the positive Key Decision One Prime, Secretary O'Leary stated, "I have concluded that construction of the National Ignition Facility supports these [U.S. nonproliferation] efforts. Therefore I have made a positive Key Decision One Prime on the issue of the NIF and nonproliferation."

Office of the NIF Formed

In December 1994, the Department of Energy created the Office of the National Ignition Facility within the Department's Defense Programs. The office, headed by Dr. David Crandall, was formed:

- To have the role of the NIF well understood by all participants and observers associated with the project.
- To bring the NIF into existence in a timely manner and maintain an envi-

ronment that allows the project to fulfill the needs of the nation and the Department of Energy.

In addition, the Department of Energy's Oakland, California, office established the NIF DOE-Field Office, which is responsible for the formal day-to-day onsite management oversight; cost and schedule control; and environment, safety, and health requirements.

Industrial Collaborations for Design and Construction

In August 1995, a multilaboratory team selected the Ralph M. Parsons Company (Pasadena, California) as the architect-engineer for the NIF Laser and Target Area Building, the primary NIF facility where the NIF laser and target chamber will be located. The team selected Parsons primarily because of their expertise in designing large, unique research facilities. Since the Key Decision One Prime announcement, the NIF Project has released approximately \$4 million to Parsons. In addition, Albert C. Martin & Associates (Los Angeles, California) was selected as the architect-engineer for the NIF Optics Assembly Building, a smaller support facility that will be used for assembly and storage of various NIF components.

Sverdrup Facilities, Inc., was selected as the NIF construction manager. They will provide construction management services for the Laser and Target Area Building and the Optical Assembly Building. Sverdrup Facilities is nationally recognized for its expertise in design and construction of highly complex scientific facilities, such as the alternate Space Launch Complex at Vandenberg Air Force Base in California.

Ongoing activities are being finalized to negotiate master task agreements—collaborations with industry to provide high-technology products and engineering in the areas of mechanical design, electrical design, optical design, and special functions.

Chronology of Key Events

October 1994 Announcement of positive Key Decision One—approval of mission need. LLNL also designated as preferred NIF site.

December 1994 Department of Energy forms the Office of the National Ignition Facility within Defense Programs. Dr. David Crandall is named Director.

February 1995 First NIF Industrial Stakeholders' Briefing. More than 350 industrial participants attended.

June 1995 National Environmental Policy Act (NEPA) process initiated—NIF addressed in a project-specific analysis within the Stockpile Stewardship and Management Program Environmental Impact Statement.

August 1995 Department of Energy issues draft study on NIF and nonproliferation. Concluded that NIF will support U.S. goals of nonproliferation.

August 1995 President Clinton announced a decision to seek a "zero" yield Comprehensive Test Ban Treaty. He stated that this decision is based upon a strong Stockpile Stewardship and Management Program.

August 1995 Ralph M. Parsons Company selected as architect-engineer for primary NIF facility. Albert C. Martin & Associates selected as architect-engineer for Optics Assembly Building.

November 1995 Energy and Water Appropriations Bill approved, including \$61 million for fiscal year 1996 NIF funding.

December 1995 Announcement of positive Key Decision One Prime—approval to start Title I engineering. Decision was based upon conclusions of final study on NIF and nonproliferation.

December 1995 NIF construction manager selected.

WWW Site for the NIF Project

The National Ignition Facility

Enhancing America's national security, energy, scientific, and economic future

Scientists anticipate achieving fusion ignition in the laboratory by the year 2005 with the National Ignition Facility (NIF), a proposed U.S. Department of Energy national center to study inertial fusion and high-energy-density science. An extremely powerful laser, consisting of 192 beams, will "ignite" small capsules containing fusion fuel, liberating more energy than is required to start the fusion reaction.

The NIF will offer significant benefits in many areas, including the following:

- National Security**
 The NIF will help to ensure the safety and reliability of the United States' nuclear weapon stockpile as part of the Department of Energy's science-based stockpile stewardship program.
- Energy**
 The NIF is the next scientific step to assessing the feasibility of inertial fusion energy. It will allow the United States to retain its role as a world leader in evaluating inertial fusion energy as an environmentally attractive energy source.
- Science**
 The NIF will provide insight into the origin of our universe by creating conditions similar to those at the center of the Sun and other stars.
- Industrial Competitiveness**
 As the world's largest precision optical instrument, technology developed for the NIF will advance key U.S. technology industries, including those in optics, lasers, integrated circuit manufacturing, and alternative applications, such as high-speed circuitry for "radar-on-a-chip" technologies.

LLNL has set up a World Wide Web (WWW) site for the NIF Project. The site contains information about the NIF's contributions to national security, science and energy research, and our national economy. The page also contains general project information, a question-and-answer forum, cost and schedule information, current project announcements, news reports, and links to other project participants and fusion research sites. The WWW address for the NIF home page is

<http://www-lasers.llnl.gov/lasers/nif.html>

Project Activities for 1996

The costs for NIF must be paid with two types of funds—operating funds and construction funds. Operating funds, also called *Other Project Costs*, will be used in 1996 for activities including environmental impact studies, advanced conceptual design studies, developing specialized optics manufacturing processes, equipment installation, and testing. Construction funds, also called *Total Estimated Costs*, will be used for Title I engineering design. The fiscal year 1996 budget for the NIF is \$61 million, of which \$23.6 million is operating funds and \$37.4 million is construction funds. Some NIF operating funds were available on October 1, 1995. The Energy and Water Appropriations Bill, passed in early November, appropriated full operating and construction funds for the NIF, but the Department of Energy decided, with LLNL support, to demonstrate good faith by withholding the construction funds until completion of the Dellums Process. On December 20, after approval of Key Decision One Prime, the Department of Energy also released the construction funds, launching the Title I engineering design effort.

The Programmatic Environmental Impact Statement (PEIS) for the Stockpile Stewardship and Management Program, which includes the environmental impact documentation for the NIF, is progressing. A Draft PEIS should be released early in 1996. Public meetings will be held around the country in March. LLNL is the DOE's "preferred site," but a final decision cannot be made before the PEIS process is complete with a Record of Decision. This should happen in September 1996.

The interlaboratory NIF Project team, including participants from LLNL, LANL, SNL, and the University of Rochester, has increased its engineering design and support contractor staff. The project team now has the equivalent of about 90 full-time people and will eventually total more than 150, excluding contract personnel. In addition, the entire Inertial Confinement Fusion Program is developing components and manufacturing processes in support of the NIF Project.

Although Congress has approved the start of the project, there are many more key decisions and congressional approvals to achieve. With engineering design under way, the next milestone will come in August or September, when the National Environmental Policy Act (NEPA) process is completed and the site is formally selected. The Title I engineering design should be completed by the end of the fiscal year. At that time, the project will seek a positive Key Decision Two to allow the final engineering design in fiscal year 1997.

Inertial Confinement Fusion

The NIF is the latest in a series of lasers built for *inertial confinement fusion* (ICF) research. The objective of inertial confinement fusion (ICF) is to compress and heat a capsule filled with fusion fuel by causing the capsule to implode (burst inward). The *driver* (applied energy source) for ICF is usually a laser (as with the NIF) or a heavy-ion beam. The driver deposits its tightly focused energy onto the capsule in a very short time, causing the surface of the capsule to vaporize. The vaporization of the capsule surface causes inward pressure, which compresses the fusion fuel inside the capsule to a high-density gas called a *plasma*. Continued energy from the driver causes the plasma to ignite (this is called *ignition*). The condition in which the fusion energy generated in the plasma exceeds the driver energy used to start the fusion reaction is called *energy gain*. Achieving fusion ignition and a corresponding energy gain is the mission of the NIF.

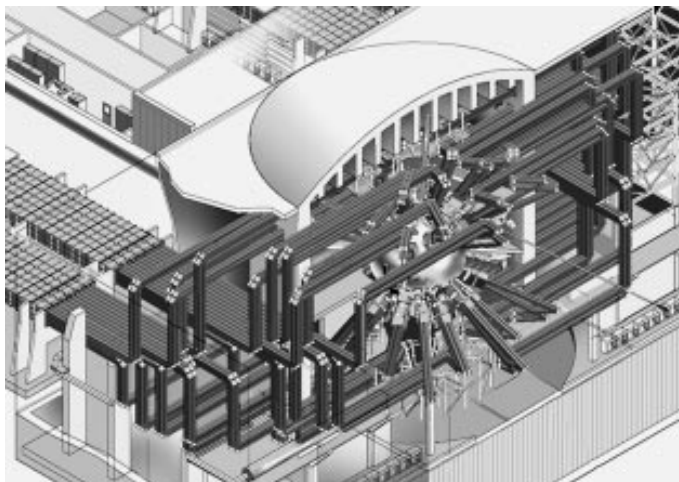
The NIF is the result of more than 30 years of ICF research. As with its predecessor, the Nova laser, it will be a national research center with multiple civilian and national security applications. The NIF will consist of four main elements:

- A laser system with optical components
- A target chamber
- An environmentally controlled facility housing the laser system and the target chamber
- An integrated computer control system

The NIF laser system is the heart of the facility and will feature 192 laser beam lines. Together, the 192 beam lines

will produce 1.8 million joules of laser energy (approximately 500 trillion watts of energy for 3 billionths of a second). In contrast, LLNL's Nova laser produces 45 thousand joules of laser energy (45 trillion watts for 1 billionth of a second).

The energy from the laser beams will be concentrated onto a 2-mm-diameter capsule (called a *target*) containing fusion fuel. The target will be located inside the NIF's *target chamber*, a 10-m-diameter sphere equipped with advanced test and measurement equipment. The collective energy from the laser light will compress and heat the fuel to produce fusion reactions, yielding up to ten times the energy delivered to the target.



The NIF laser beams will enter from the target chamber's top and bottom. Diagnostic equipment occupies the middle of the chamber.